

## REMARKS

All outstanding requirements will now be addressed in the order they appear in the Office Action mailed October 29, 2009.

### *Claim Rejections – 35 USC § 112, Second Paragraph*

Claims 12-14 stand rejected under 35 USC 112, second paragraph, as being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

**Regarding claims 12-14,** it is unclear to the Examiner as to what the thickness of each of the layers is supposed to be as the specification provides no guidance as to what the thickness is supposed to be.

Applicants respectfully disagree and request reconsideration. Applicants submit that the optical thickness of each layer is well defined in the specification and claims. Specifically, claim 11 (now amended to include the limitations of canceled claim 12) recites that **the optical thickness of the first layer① is between the optical thickness③ of the silver-white interference color② and the optical thickness of the golden-yellow interference color.** To explain what this means, Applicants restate below what is well known in optics.

**① Optical thickness** of thin films:  $b = n*d$ , wherein b represents optical thickness, n represents the refractive index, and d represents the physical (geometric) thickness.

**②** When two monochromatic coherent waves produce interference, a series of bright and dark stripes is produced, which is called interference fringe. When white light produces interference, a series of color stripes from purple to red are produced. Colors resulting from the interference are called **interference colors**.

A difference in optical path length between two paths is called **optical path difference**. Optical path difference determines the characteristics of interference fringes. Specifically, it is the difference between the travel distances of two coherent lights from different luminous points traveling to reach an overlapping point. Optical path (nr) is a product obtained by multiplying the path (r) that light takes in a medium by refractive index (n) in the medium.

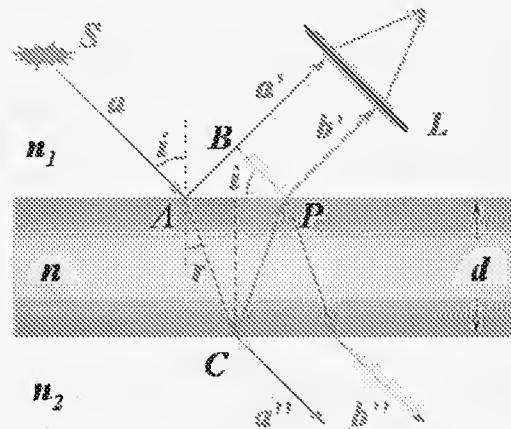
For two coherent lights from two coherent light sources of the same phase, the bright and dark of the interference stripes are determined by the optical path difference  $\Delta$ . The color of the interference stripes are determined by the optical path difference between the two beams of coherent light. For example, take white light as light source, if the optical path difference is between 0 and 550 nm, the interference color will be dark gray and gray in sequence, which is called the first order of interference color, featuring dark gray and gray, without blue and green.

If the optical path difference is between 550 and 1100 nm, the interference colors will be blue, green, yellow, orange, and purple in sequence. This is the second order of interference colors, featuring bright color and clear boundaries between the interference colors. If the optical path difference is between 1100 and 1650 nm, third order interference colors occur, which are in the same order in sequence as for the second order of interference colors, but lighter, and the boundary between the interference colors is not as clear. If the optical path difference is above 1650 nm, the fourth or above order of interference colors is produced. The higher the order of the interference colors, the lighter the color, and the more unclear the boundary between the interference colors.

Although due to limitations of electronic file submission through EFS web, it is difficult to reproduce here an interference color chart, the Examiner can easily access such charts online as they are well known in the art. At the time of submission of this reply, an interference color chart could be accessed, for example, at <http://www.eos.ubc.ca/courses/eosc221/optics/intchart.html>. The chart clearly shows interference colors including silver-light and golden yellow and optical path difference (in nm) corresponding thereto.

### ③ Optical path difference vs. optical thickness of interference colors

The formula relating optical thickness of interference colors and optical path difference (see ②) for thin film interference is deduced from figure below as follows.



As shown in the figure, **a** represents a monochromatic light. **n** is the refractive index of a thin film with a thickness of **d**. **a'** and **b'** are two parallel beams of reflected light resulted from the reflection of the monochromatic light **a** on the upper and lower surface of the thin film respectively. Since the two parallel beams **a'** and **b'** are produced by dividing the monochromatic light **a** according to intensity, they are two coherent lights.

The optical path difference between the two beams  $\Delta L$  is

$$\begin{aligned}\Delta L &= n(AC + CP) - n_1 AB + \frac{\lambda}{2} = 2nAC - n_1 AP \sin i + \frac{\lambda}{2} \\ &= 2n \frac{d}{\cos r} - 2d \frac{\sin r}{\cos r} \cdot n \sin r + \frac{\lambda}{2} = \frac{2nd}{\cos r} (1 - \sin^2 r) + \frac{\lambda}{2} \\ &= 2nd \sqrt{1 - \sin^2 r} + \frac{\lambda}{2}\end{aligned}$$

wherein **nd** is the optical thickness.

Based on Snell's Refraction Law  $n_1 \sin i = n \sin r$ , the formula of optical path difference for

$$\Delta L = 2d \sqrt{n^2 - n_1^2 \sin^2 i} + \frac{\lambda}{2},$$

thin film interference is

Accordingly, Applicants respectfully submit that it is clear as to what the terms optical thickness of silver-white interference color and optical thickness of golden-yellow interference color mean, and thus it is also clear what the thickness of the layers is supposed to be.

**Regarding claims 12,** it is unclear to the Examiner as to what is meant by the phrase "the thickness of said first layer is between the optical thickness of the silver-white interference color and the optical thickness of the golden yellow interference color". That is, what exactly does the term "between" refer to? The phrases "the thickness", "the optical thickness", "the silver-white interference color", and "the golden yellow interference color" lack proper antecedent basis. Note that claim 11 makes no mention as to the presence of a silver white interference color or a golden yellow interference color and accordingly it is unclear as to the exact scope of the claim.

Applicants have explained above the terms "the optical thickness of the silver-white interference color" and "the optical thickness of the golden yellow interference color". Regarding "between", it is simply a preposition indicating that the value of the optical thickness of the first layer falls into the optical thickness interval separating the optical thickness of the silver-white interference color and the optical thickness of the golden yellow interference color. To make this clearer, Applicants have amended the claims to use the terms "grater than" and "smaller than" instead, which are another way of expressing the same concept. In addition, Applicants have substituted the definite articles "the" by the indefinite articles "a/an" to overcome the Examiner's rejection with respect to lack of proper antecedent basis.

**Regarding claim 13,** the phrases "the thickness", "the optical thickness" and "the 2nd order interference color" are alleged to lack proper antecedent basis. The Examiner notes that claim 11 makes no mention as to the presence of a 2nd order interference color and accordingly it is unclear as to the exact scope of the claim.

In response, Applicants have substituted the definite articles "the" by the indefinite articles "a/an" to overcome the Examiner's rejection with respect to lack of proper antecedent basis. All other necessary explanations have been provided above.

**Regarding claim 14,** it is unclear to the Examiner as to what is meant by the phrase "the thickness of said second layer is between the optical thickness of 2nd order green interference color and the optical thickness of the 4th order interference color". It is also not clear to the Examiner what exactly does the term "between" refer to? The phrases "the thickness", "the optical thickness", and "the 4th order interference color" allegedly lack proper antecedent basis. The phrases "2nd order green interference color" and "the 4th order interference color" are not understood by the Examiner as claim 11 makes no reference to these interference colors so it is unclear as to what exactly applicant is trying to claim.

In response, Applicants have substituted the definite articles "the" by the indefinite articles "a/an" to overcome the Examiner's rejection with respect to lack of proper antecedent basis. All other necessary explanations have been provided above.

### ***Claim Rejections – 35 USC § 102 and 103***

Claims 11 and 15-16 stand rejected under 35 U.S.C. 102(b) as being allegedly anticipated by U.S. Patent Application Publication No. 2002/0104461 to Schmidt et al. Claims 11 and 15-16 are also rejected under 35 U.S.C. 102(b) as being allegedly anticipated by U.S. Patent No. 6,579,355 to Schmidt et al. In addition, claim 17 is rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Schmidt et al. ('355) as applied to claim 11 above, and further in view of U.S. Patent No. 4,482,389 to Franz et al.

Without acquiescing in the rejections, Applicants have amended claim 11 without prejudice by adding the limitation of claim 12. Since claim 12 was not previously rejected over prior art, claim 11 should likewise not be rejected.

Applicants do not give up any rights to any subject matter that may have been removed from the claims relative to prior versions as a result of this amendment. Applicants reserve the right to prosecute in continuing applications any subject matter that may have been removed from the claims relative to prior versions. Applicants reserve the right to prosecute in continuing applications claims identical or similar in scope to claims that were presented in prior versions.

### ***CONCLUSION***

In view of the foregoing amendments and remarks, Applicant submits that the pending claims are in condition for allowance. Early and favorable reconsideration is respectfully solicited. Should an extension of time be required, Applicants hereby petition for same and request that the extension fee and any other fee required for timely consideration of this submission be charged to **Deposit Account No. 503182** to the extent that the fees were not already submitted though EFS-Web.

Customer Number: **33,794**

Respectfully Submitted,

/Matthias Scholl/

Dr. Matthias Scholl, Esq.  
Reg. No. 54,947

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